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TREATMENT OF WOOL SCOURING EFFLUENT

W. Lapsirikul and G. E. Ho

Institute for Environmental Sciences
Murdoch University, Murdoch 6150
Western Australia

INTRODUCTION

Effluent from the wool scouring industry is considered to be the most strongly polluting waste in the whole textile industry (Anderson & Wood, 1973). It typically contains 3,000 to 21,000 mg/l wool grease, 7,000 to 15,000 mg/l suint salts (salt produced by natural excretions) and 10,000 to 30,000 mg/l dirt (sand, vegetable matter and fibre). The biological oxygen demand (BOD) and chemical oxygen demand (COD) of the effluent can be as high as 40,000 mg/l and 120,000 mg/l respectively (Anderson & Wood, 1973; Cail *et al.*, 1986; Christoe & Bateup, 1987; Genon *et al.*, 1986).

Since wool grease can be recovered as a saleable by product (lanolin) a majority of scouring plants around the world use disc centrifuges to recover this valuable product (Christoe & Bateup, 1987). However, only the best quality of grease (approximately 25 to 45% of the total) is removed. The concentration of grease as well as other pollutants in the final discharge is still too high for their disposal to be considered environmentally acceptable. For this reason, further treatment is required.

EXISTING METHODS OF TREATMENT

Various physico-chemical methods to purify wool scouring effluent prior to discharge to the environment have been investigated. Some of them such as acid cracking and chemical flocculation have been proven to remove a high proportion of pollutants. However, the processes become very expensive and are not feasible for use in small plants. Biological processes appear to be more promising in this case.

Anaerobic digestion has been shown to reduce the level of pollutants in wool scouring wastewater (Cail *et al.*, 1986; Genon *et al.*, 1984; Rodmell & Wilkie, 1983; Whitaker & Stewart, 1985). However, since conventional digestion is commonly used, the process encounters the problem of long detention time which requires a large reactor. As a result, the capital cost for this process is quite high.

Over the last twenty-five years "high rate" anaerobic processes have been developed. As implied by the name, pollutant removal rates are increased using these processes thereby requiring a much smaller reactor to treat a given amount of waste than conventional anaerobic treatment processes. However, this process is more effective in treating wastewater containing soluble COD rather than suspended COD. Therefore, pretreatment processes to remove as much of the suspended solids are required.

In wool scouring effluent, besides dirt, particular problems are posed by woolgrease which is not readily biodegradable (Chao & Yang, 1981), and detergents, which produce relatively stable emulsion. The removal of dirt especially settleable solids can be done easily by a properly designed sedimentation tank but the removal of woolgrease needs a much more complicated process.

PLANT SURVEY

A survey was conducted at Jandakot Wool Scouring Co. Pty. Ltd. during September and December 1990 to provide baseline information about quantity and quality of waste streams from a wool scouring plant. Fig. 1 shows the schematic diagram of the plant and sampling sites. Fig. 2 and table 1 show the characteristics of different waste streams from the plant.

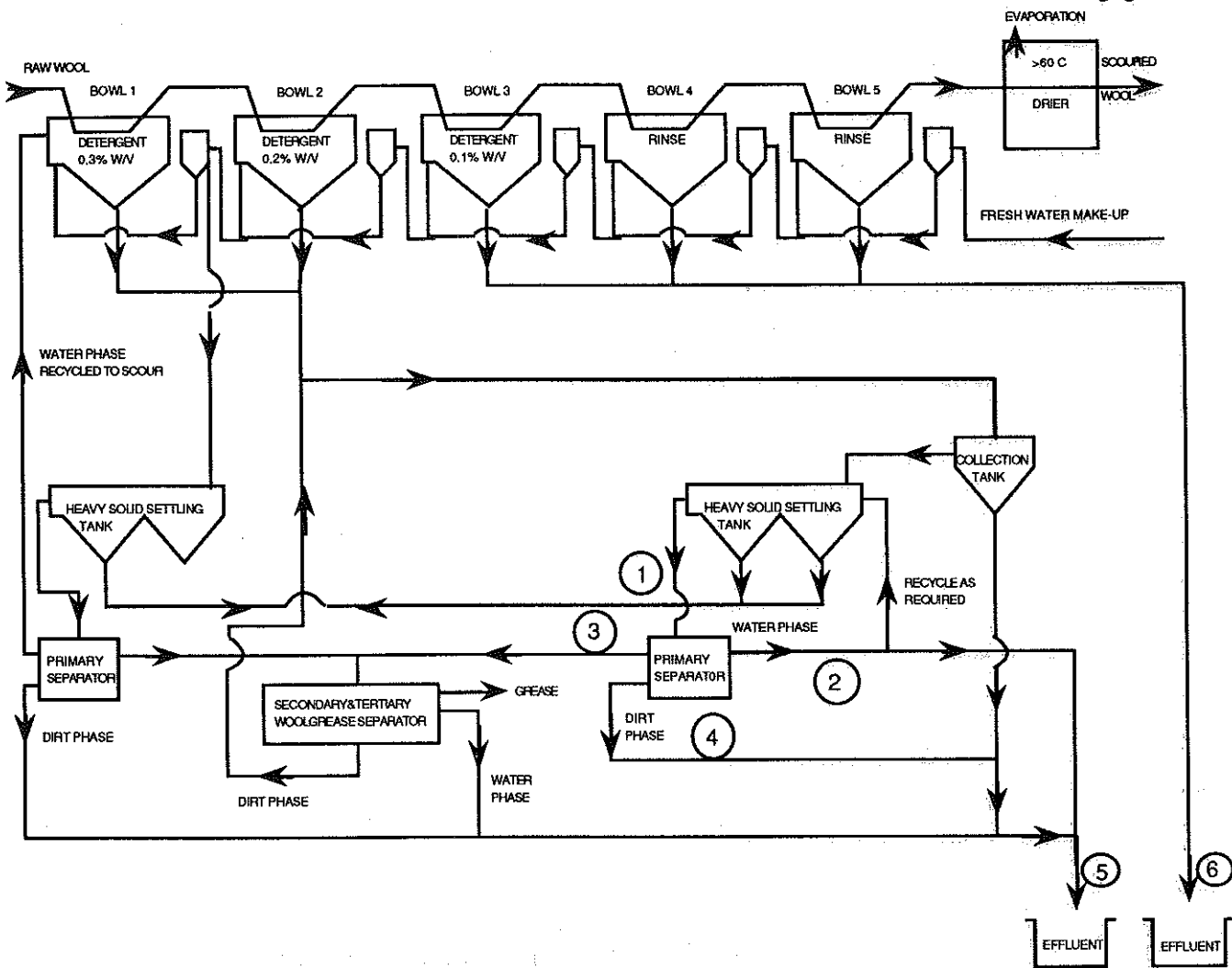


Figure 1 Jandakot wool scouring plant and sampling sites

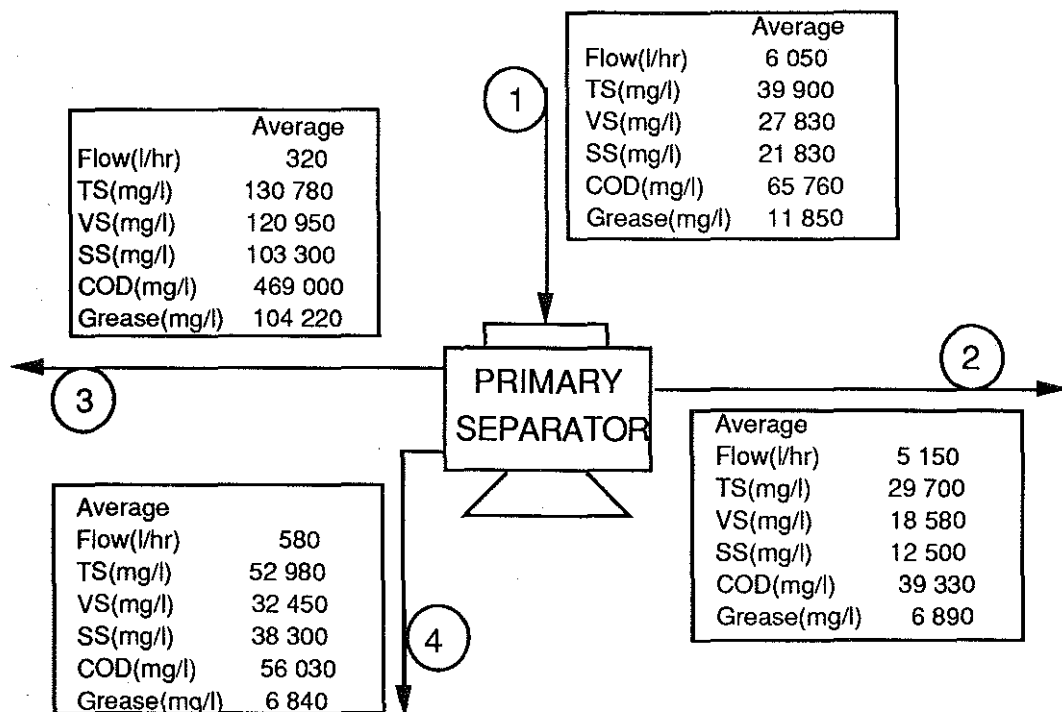


Figure 2 Characteristics of Liquor around Primary Separator

Table 1 Characteristics of wastewater from Jandakot Wool Scouring Plant

Parameters	Wash stream (No.5)	Rinse stream (No.6)
Flow rate (l/hr)	12 600	4 693
Total solids (mg/l)	56 000	8 400
Volatile solids (mg/l)	33 400	4 300
Suspended solids(mg/l)	34 800	4 200
BOD ₅ (mg/l)	19 750	2 800
COD (mg/l)	67 000	9 500
Grease (mg/l)	8 520	800

EXPERIMENTAL DESIGN

According to the survey two main streams, wash stream and rinse stream, contain remarkably different concentrations in terms of pollutants. The combination of these two streams produces a waste which is high in quantity and pollutant concentration. Separate treatment processes are possible, as shown in Fig 3.

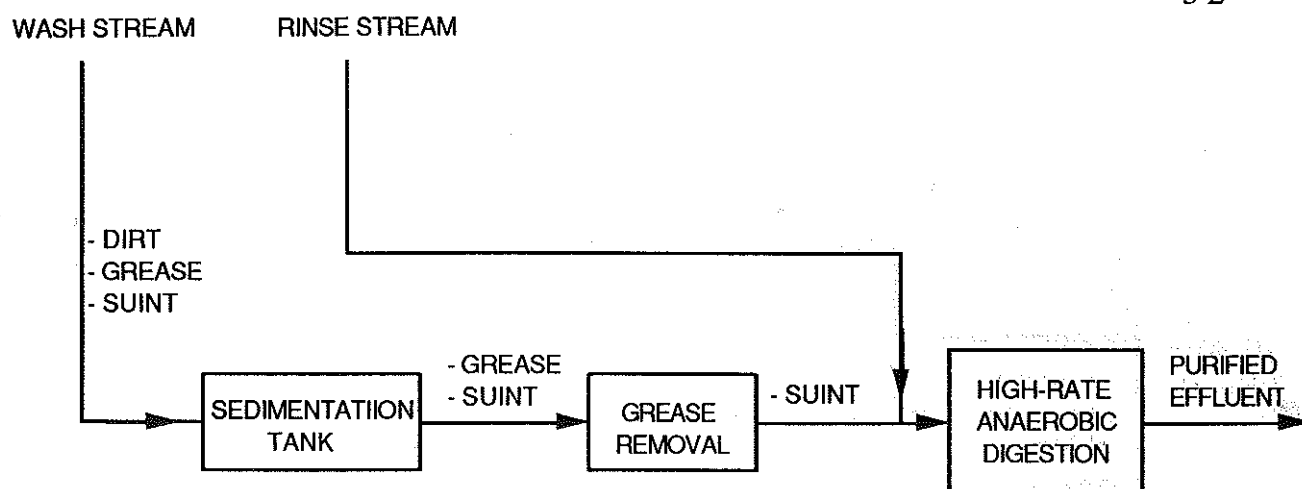


Figure 3 Proposed Treatment Processes for Wool Scouring Effluent

In these processes, wastewater from the wash stream is passed to a sedimentation tank to remove settleable solids and then to a grease removal process. Afterward, the wastewater containing mainly suint with a small amount of grease and dirt will be combined with the rinse stream and finally treated by high-rate anaerobic digestion.

The project thereby is divided into 2 phases.

In the first phase, the destabilization of lanolin by anaerobic bioflocculation will be investigated as pretreatment processes. Several parameters such as temperature, pH, loading rate, as well as nutrient requirement will be optimized in order to achieve maximal separation of grease from the water phase in the shortest residence time. At the end of this phase, optimum pretreatment techniques are expected.

In the second phase, experiments will be conducted in the further purification of degreased liquor from the first phase by using high rate anaerobic digestion. Optimization of the process will be investigated, based on maximal COD removal efficiency and minimal hydraulic residence time.

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